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Early Predictors of Occupational Back Re-Injury: Results from a Prospective Study of Workers in Washington State

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Abstract

Study Design—Prospective population-based cohort study

Objective—To identify early predictors of self-reported occupational back re-injury within 1 year after work-related back injury

Summary of Background Data—Back injuries are the costliest and most prevalent disabling occupational injuries in the United States. A substantial proportion of workers with back injuries have re-injuries after returning to work, yet there are few studies of risk factors for occupational back re-injuries.

Methods—We aimed to identify the incidence and early (in the claim) predictors of self-reported back re-injury by approximately 1 year after the index injury among Washington State workers with new work disability claims for back injuries. The Washington Workers' Compensation Disability Risk Identification Study Cohort (D-RISC) provided a large, population-based sample with information on variables in seven domains: sociodemographic, employment-related, pain and function, clinical status, health care, health behavior, and psychological. We conducted telephone

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interviews with workers 3 weeks and 1 year after submission of a time-loss claim for the injury. We first identified predictors (p-values < 0.10) of self-reported re-injury within 1 year in bivariate analyses. Those variables were then included in a multivariate logistic regression model predicting occupational back re-injury.

Results—290 (25.8%) of 1,123 (70.0% response rate) workers who completed the one-year follow-up interview and had returned to work reported having re-injured their back at work. Baseline variables significantly associated with re-injury (p-value < 0.05) in the multivariate model included male gender, constant whole body vibration at work, a history of previous similar injury, 4 or more previous claims of any type, possessing health insurance, and high fear-avoidance scores. Baseline obesity was associated with reduced odds of re-injury. No other employment-related or psychological variables were significant.

Conclusion—One-fourth of workers who received work disability compensation for a back injury self-reported re-injury after returning to work. Baseline variables in multiple domains predicted occupational back re-injury. Increased knowledge of early risk factors for re-injury may help lead to interventions, such as efforts to reduce fear-avoidance and graded activity to promote recovery, effective in lowering the risk of re-injury.

Keywords

Back injuries; injured workers; predictors; prospective study; re-injuries; workers' compensation

Introduction

Back pain is the costliest and most prevalent disabling occupational disorder in the United States.[1, 2] Costs related to occupational back pain and injuries have increased 65% (in real dollars) in recent years.[3] Workers with back re-injuries or pain recurrences have higher costs and durations of disability,[4] yet occupational back re-injuries are rarely studied relative to initial injuries.[5] No generally agreed upon case definition of occupational back re-injury exists, challenging further research efforts in this field. Additionally, re-injuries are not distinguished among general occupational injuries by the US Bureau of Labor Statistics; national re-injury statistics are unavailable.[5] Reported prevalence estimates range from 5-82%;[6] this wide range likely reflects the variation and inconsistency regarding definitions and data sources. In addition, few predictors of re-injury have been assessed across multiple studies and even when the same variable has been assessed in multiple studies, there have been conflicting findings.[4 - 12] Identification of early (in a worker's compensation claim) predictors of occupational back re-injury may assist in focusing re-injury prevention efforts on workers at high risk, with the potential to lower the risks of occupational back re-injury and long-term disability, and reduce associated medical and lost work time costs.

We used the Washington State Workers' Compensation Disability Risk Identification Study Cohort (D-RISC) data to examine the rate of occupational back re-injury by 1 year, identify early predictors of occupational back re-injury, develop a multivariate predictive model, and evaluate the ability of the multivariate model to predict re-injury. Possible predictive variables were identified within domains of interest that were used previously for occupational injury research.[13 – 16] Seven domains (sociodemographic, employment-related,

pain and function, clinical status, health care, health behavior, and psychological)[13] were assessed in baseline telephone interviews to identify potential risk factors for self-reported occupational back re-injury. Based on previous research, we hypothesized that initial injury severity, worker fear-avoidance, prior work injury, Roland Morris Disability Questionnaire (RMDQ) score,[19] lack of offer of job accommodation, poor overall health status, and lack of provider mention of re-injury prevention strategies would be significant predictors of re-injury.[2, 5, 13, 17, 18]

Materials and Methods

Setting and Participants

The D-RISC study has been described in previous reports.[13, 14] D-RISC was a prospective, population-based study that identified workers with new occupational back injury claims in the Washington State Department of Labor and Industries (DLI) state fund claims database between June 2002 and April 2004. To be eligible for the study, workers must have received at least one day of temporary total disability wage replacement. All non-federal employees in the state whose employer does not self-insure (approximately two-thirds of the non-federal workforce) are covered by the DLI state fund. Injured workers were identified by weekly claims review.

From the claims database, 4,354 potential participants were identified for D-RISC. Of those, 1178 (27.1%) could not be contacted, 909 (20.9%) declined enrollment, and 120 (2.8%) could not complete the initial phone interview in English or Spanish. The remaining 2147 (49.3%) were enrolled in D-RISC and completed the baseline interview. The baseline interviews were conducted a median of 18 days (range 10-58) days after claim submission. *At the time of* the baseline interview, the median number of days of time loss compensation (which begins when four days of work have been missed due to the injury) in the sample was 14 (inter-quartile range 4 – 24 days). 94% of the sample had less than 6 weeks of time loss compensation at the time of the baseline interview. After the baseline interview, study participants were excluded from the analysis sample if they were not eligible for wage replacement compensation (n=240), were hospitalized for the initial injury (n=16), were missing data on age (n=3), or did not have a back injury according to medical record review (n=3). Thus, 1885 (43.3%) were included in the original D-RISC analysis sample. This sample, compared to those who received compensation but were not in the study, was slightly older [mean age (SD) = 39.4 (11.2) vs. 38.2 (11.1) years, P = 0.001]; contained more women (32% vs. 26%, P < 0.001); and had more workers receiving wage-disability compensation after 1 year (13.8% vs. 11.3%, P = 0.02).[13]

Of the 1885, 1319 (70.0%) completed the 1-year follow-up interview. Compared to the 566 workers who did not complete the 1-year follow-up assessment, the 1319 who did complete the one-year follow-up were slightly older on average [mean age (SD) = 40.3 (11.1) vs. 37.1 (11.2) years, P < 0.001]; more educated (less than high school education: 11% vs. 19%, P = 0.006); less likely to be Hispanic (14% vs. 22%, P < 0.001); more likely to be married or living with partners (68% vs. 57%, P < 0.001); and more likely to have general health insurance (72% vs. 58%, P < 0.001). The two groups did not differ significantly in time-loss days by 1 year [mean time-loss (SD) = 85 (126) vs. 79 (119) days, P = 0.33). Of the 1319

workers, 13 workers declined or did not know the answer to the question in the follow-up interview indicating re-injury status, and 183 workers reported that they never returned to any paid work in the year after the baseline interview (and hence could not be re-injured while at work). Thus, 1,123 injured workers (25.8% of the 4,354 originally-identified potential study participants) were included for our analyses.

Measures

Baseline variables—111 variables were assessed during the D-RISC structured telephone baseline interview, while 13 variables were obtained from DLI and patient medical records. Baseline measures were selected primarily based upon previous occupational back re-injury research that suggested their potential importance. Because the occupational back re-injury literature is sparse, variables were also selected based upon related injury or worker's compensation research, such as that predicting chronic disability as a result of occupational back injury.[13] Baseline information from the DLI included region of the worker's residence, employer size, industry type, and time from injury to first medical visit. Worker medical records were reviewed to rate injury severity.[16] 54 of 124 (43.5%) available variables were investigated in this analysis. Please see Table 1 and the Appendix for more information about the baseline variables.

Outcome measure—The D-RISC 1-year follow-up structured telephone interview included the following yes/no question used as the outcome variable:

> "Since you filed a claim for your back injury around [claim date], have you re-injured your back at work?"

Statistical Analyses

We first conducted logistic regression analyses to examine bivariate associations between baseline variables of interest and re-injury, adjusted for age and gender. Missing, unknown, and refusal answers for each variable were combined into one response and included in the analysis. Variables that were associated with re-injury bivariately were examined for collinearity or redundancy prior to forming the multivariate model.

We then constructed a multivariate model for predicting re-injury that included all baseline variables that were associated ($P < 0.10$) with re-injury in bivariate analyses, along with age (as an adjustment variable). This criterion was used because a standard 0.05 p-value level in a bivariate analysis may exclude variables that may be significant in a multivariate model.[13,26] Analyses were conducted using Stata Version 10.[27]

In order to evaluate the ability of the multivariate model to distinguish between workers who did versus did not report an occupational back re-injury by 1 year, we determined the area under the receiver operating characteristic curve (AUC) by using 10-fold cross-validation to estimate the AUC in different sub-samples of the D-RISC data.[28] An AUC over 0.70 is considered acceptable.[26]

Results

Sample Characteristics

The sample of workers (N=1,123) was mostly white non-Hispanic (73%; 14% Hispanic; and 14% other) and male (67%). One year after the baseline interview, 290 (25.8%) of the 1,123 workers reported one or more occupational back re-injuries. Variables with the most missing data included region of worker residence (n=33), time from injury to first medical visit (n=31), source of blame for the injury (n=24), work days missed due to non-back health problems in the previous year (n=21), work days missed due to back problems in the previous year (n=14), whether the supervisor listens to work-related problems (n=12), and whether the employer offered job accommodations (n=10).

Bivariate Analyses

Table 1 displays baseline variables that were associated ($P < 0.10$) with occupational back re-injury. (See the Appendix for the non-significant variables.) All domains contained at least one association. In the sociodemographic domain, gender and race/ethnicity were associated with re-injury. In the employment-related domain, overall amounts of heavy lifting, whole body vibration, physical demands, fast pace, and excessive amounts of work were associated with re-injury. Neither employer-specific variable (employer size and industry) was related to re-injury.

In the pain and function domain, number of pain sites, pain intensity in the past week, the worker's RMDQ score,[19] and SF-36 Version 2[24] physical function and role-physical scores were associated with re-injury. Several variables in the clinical domain were associated with re-injury, including a history of previous similar back injury, having a previous occupational injury of any type that resulted in at least one month off work, self-reported previous claims (any type) before the current injury, and work days missed in the previous year for non-back health reasons. In the health care domain, not having general health insurance was associated with a lower risk of re-injury. BMI was the only ($P < 0.10$) predictor in the health behavior domain. In the psychological domain, the worker's source of blame for the injury, fear-avoidance, and SF-36v2 mental health score were associated with re-injury. Some anticipated predictors of re-injury, including initial injury severity, lack of offer of job accommodation, poor overall health status, and lack of provider mention of re-injury prevention strategies, were not associated bivariately with re-injury.

Multivariate Model

The multivariate model (Table 2) includes age, gender, and other variables that were associated with re-injury bivariately. Seven variables from 6 domains contributed significantly ($P < 0.05$) to the prediction of self-reported occupational back re-injury by 1 year. These include male gender, constant whole body vibration, history of previous similar back injury, more than 3 previous worker's compensation claims of any type before this injury, having health insurance, obesity (BMI ≥ 30), and elevated work fear-avoidance scores.

Due to concern about having too many similar pain and function variables in the multivariate model (i.e. collinearity), we conducted a sensitivity analysis repeating the logistic regression with only two baseline variables from this domain, chosen based on past research showing their relationship to subsequent clinical outcomes[7, 13]: the number of pain sites and the RMDQ score. None of the baseline measures of pain and function variables were statistically significant in either multivariate model. We had anticipated that the RMDQ score would be significant.

The cross-validated AUC value was 0.72 (95% CI 0.69 – 0.76), indicating a near-acceptable ability of the model to distinguish workers who reported a re-injury by 1 year from those who did not.[26]

The strongest predictors of occupational back re-injury in the multivariate model were the number of prior worker's compensation claims and the baseline fear-avoidance score. Workers who reported more than 3 prior claims had 2.29 times the odds (95% CI 1.34 – 3.92) of self-reported re-injury as compared with workers who reported no previous claims. Compared to workers with low fear-avoidance (score <3), workers with high (score of 5 to 6) or low-moderate (3 to <5) fear-avoidance scores had approximately twice the odds of reporting a re-injury [OR=2.03 (95% CI 1.27 – 3.23) and OR=1.84 (95% CI 1.13 – 2.99), respectively].

Discussion

To our knowledge, this is the first population-based study to examine early predictors of occupational back re-injury from multiple domains of potential risk factors across all industries. Variables from 6 domains (sociodemographic, employment-related, clinical status, health care, health behavior, and psychological) were significant early predictors of occupational back re-injury. This suggests that back re-injuries may be influenced by factors beyond aspects of clinical care and the severity of the initial injury.[13]

The strongest predictor in the final multivariate model was self-report of more than 3 previous worker's compensation claims of any type, even after adjustment for a previous similar back injury. To our knowledge, the worker's history of claims has not been examined in previous occupational back re-injury literature. Further research is needed to better understand why a history of previous claims is associated with greater odds of re-injury, and how knowledge of previous claims could be used to help prevent re-injury.

Fear-avoidance has been found to be associated with occupational disability in previous studies.[13, 15] However, we are not aware of prior research examining fear-avoidance as a predictor of occupational back re-injury. It is notable that a variable in the psychological domain predicts re-injury even after adjustment for measures of pain and function. It is possible that workers may be accurate that their jobs will cause "re-injury" or that these beliefs may lead them to perceive any increases in pain as a re-injury after returning to work. This study contributes to the body of research supporting the potential value of screening patients with back injuries for psychological factors such as fear-avoidance that may affect their clinical outcomes, and suggests the importance of assessing fear-avoidance early after

injury and addressing fear-avoidance when present (e.g., through education and graded activity to promote recovery).[13]

Worker self-report of whole body vibration in job tasks (e.g., using a jackhammer or driving a forklift) contributed independently to the prediction of re-injury in the multivariate model. To our knowledge, this variable has not been examined in other studies of predictors of occupational re-injury. A number of other job demands variables were predictive of re-injury when examined bivariately; similarly, prior occupational back re-injury studies have found significant predictors related to job demands, including a fast-paced environment[7, 8] and physical demands.[7 - 9] Our results were also consistent with those of previous studies that found no association between re-injury and worker job satisfaction.[10]

Surprisingly, not having general health insurance was associated with lower odds of back re-injury. One previous study found that having general health insurance was significantly and positively associated with reporting and seeking treatment for occupational injuries.[29] It is possible that workers who have general health insurance may be more likely to self-report an injury because care will be covered by insurance even if they do not have an accepted worker's compensation claim for the injury. It is also possible that this variable is a marker for another unmeasured characteristic associated with re-injury or a reflection of baseline differences between our analysis sample and other D-RISC participants that did not complete the 1-year follow-up interview.

Compared to workers of normal weight, obese participants (BMI ≥ 30) had lower odds of occupational back re-injury. One previous study that assessed BMI found no association with re-injury.[8] Multiple studies have observed associations between obesity and occupational back injuries, including higher rates of initial injuries.[17, 30, 31] Obese workers have also been found to have lower physical productivity.[32] Obese workers may be more likely to have jobs that do not have physical demands associated with re-injury; however, we are unaware of any scientific literature supporting this conjecture. In additional bivariate analyses of our data, we found that obese participants were significantly less likely to report a fast pace or excessive amount of work compared to participants of normal weight; however, no other physical job demands differences were found.

Our study has some limitations. First, the outcome was a binary yes-no question about back re-injury; we do not have information concerning the extent and severity of the re-injury. Our response rate for the 1-year follow-up interview was 70.0% of the participants who completed the baseline interview, and respondents and non-respondents differed significantly on some baseline measures. The length of time back at work after the index injury (and hence the time which workers could have had a re-injury) was not assessed in this study and may have varied widely across the sample. In the original D-RISC sample, 69% of workers ended work disability benefits within 3 months of their index claim submission; (data not shown). These data suggest that most workers in the current study had been back at work at least nine months by the one-year follow-up interview. We did not assess some variables found in previous studies to be associated with occupational back re-injury, including a history of substance abuse,[9] the ratio of salary to wage-loss payments,[9] and the lengths of previous employment.[9] Finally, we analyzed a large number of variables

and some associations might have been significant due to chance alone. The analyses were exploratory, hypothesis-generating, and intended to reveal factors that should be tested in future studies. Despite these limitations, this study has numerous strengths, including a large, population-based sample across all industries; a prospective design; several sources of baseline data; and baseline variables reflecting multiple domains of interest.

In sum, biological, psychosocial, and environmental factors may all be involved in occupational back re-injury. Approximately 25% of our sample reported an occupational back re-injury within one year of initial submission of a claim involving loss of at least four days of work due to back injury. Understanding risk factors for occupational back re-injury may increase knowledge about why some workers are re-injured while others are not. This knowledge may lead to improved re-injury prevention efforts by employees, employers, and providers.

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Appendix. Non-Significant Bivariate Associations (P > 0.10) of Baseline Variables with Occupational Back Re-Injury by One Year After Initial Occupational Back Injury

Domain and variables	Not re-injured N=833 % (n)	Re-injured N=290 % (n)	Odds ratio^	95% CI	P-value
Sociodemographic					
Age, years (ref= 35-44 years)	30 (250)	31 (89)			0.16
≤24 years	10 (85)	6 (16)	0.53	0.29 – 0.95	
25 – 34 years	23 (191)	27 (77)	1.13	0.79 – 1.62	
45 – 54 years	26 (214)	28 (80)	1.05	0.74 – 1.49	
≥ 55 years	11 (93)	10 (28)	0.85	0.52 – 1.38	
Region of worker residence † (ref=urban)	58 (481)	59 (171)			0.92
Suburban	17 (139)	15 (44)	0.89	0.61 – 1.32	
Large town	12 (100)	12 (34)	0.97	0.63 – 1.49	
Rural	11 (92)	10 (29)	0.89	0.57 – 1.41	
Education (ref=high school)	33 (273)	28 (80)			0.46
Less than high school	10 (84)	11 (31)	1.19	0.73 – 1.94	
Vocational or some college	46 (387)	50 (145)	1.27	0.93 – 1.75	
College	11 (89)	12(34)	1.33	0.83 – 2.13	
Marital status (ref=married/living with partner)	68 (565)	71 (207)			0.65
Other	32 (268)	29 (83)	0.93	0.69 – 1.26	
Employment-related					
Worker's Employer size (ref=>200 employees)	23 (195)	26 (74)			0.37

Domain and variables	Not re-injured N=833 % (n)	Re-injured N=290 % (n)	Odds ratio^	95% CI	P-value
76 – 200 employees	21 (173)	15 (43)	0.63	0.41 – 0.98	
26 – 75 employees	22 (180)	23 (67)	0.92	0.62 – 1.37	
11 – 25 employees	16 (134)	18 (51)	0.89	0.58 – 1.36	
1 – 10 employees	18 (148)	18 (53)	0.82	0.54 – 1.26	
Worker's industry ‡ (ref=trade/transportation)	24 (197)	29 (85)			0.80
Natural resources	5 (41)	4 (13)	0.69	0.35 – 1.36	
Construction	15 (128)	17 (49)	0.82	0.54 – 1.25	
Manufacturing	7 (55)	8 (22)	0.90	0.51 – 1.57	
Management	19 (158)	17 (49)	0.73	0.48 – 1.10	
Education and health	18 (148)	14 (41)	0.84	0.53 – 1.35	
Hospitality	13 (106)	11 (31)	0.78	0.48 – 1.27	
Worker's description of job in following variables					
Enough time to do job (ref=Strongly agree/agree)	26 (216)	30 (87)			0.11
Strongly disagree/disagree	74 (617)	70 (203)	0.79	0.58 – 1.06	
Very hectic (ref=Strongly disagree/disagree)	28 (232)	29 (85)			0.29
Agree	46 (385)	44 (127)	0.94	0.68 – 1.30	
Strongly agree	26 (213)	27 (78)	1.16	0.80 – 1.68	
Able to take breaks when desired (ref=Strongly disagree/disagree)	50 (416)	51 (148)			0.39
Strongly agree/agree	50 (417)	49 (142)	0.89	0.68 – 1.17	
Supervisor listens to my work problems (ref=agree)	58 (481)	58 (168)			0.32
Strongly disagree/disagree	18 (153)	16 (47)	0.93	0.64 – 1.37	
Strongly agree	23 (193)	24 (69)	1.08	0.78 – 1.50	
Satisfaction with job (ref=Somewhat or very satisfied)	87 (724)	89 (257)			0.68
Not at all or not too satisfied	13 (109)	11 (33)	0.92	0.60 – 1.40	
Co-worker relations (0 – 10 scale, ref=10, get along extremely well)	52 (434)	48 (139)			0.50
9	19 (156)	18 (52)	1.03	0.71 – 1.50	
8	19 (159)	21 (61)	1.18	0.83 – 1.68	
0 – 7	9 (78)	13 (37)	1.42	0.91 – 2.21	
Job type at time of injury (ref=full-time) Part-time	91 (755)	94 (274)			0.23
Part-time	9 (77)	6 (16)	0.71	0.41 – 1.24	
Seasonal job at injury (ref=no)	94 (786)	96 (278)			0.70
Yes	6 (47)	4 (11)	1.07	0.75 – 1.53	
Temporary job at injury (ref=no)	94 (783)	97 (280)			0.13
Yes	6 (47)	3 (10)	0.59	0.30 – 1.16	
Job duration ≥ 6 months	81 (673)	82 (237)			0.98
< 6 months	19 (160)	18 (53)	1.00	0.70 – 1.43	

Domain and variables	Not re-injured N=833 % (n)	Re-injured N=290 % (n)	Odds ratio^	95% CI	P-value
Employer offered job accommodation (ref=Yes)	52 (432)	48 (139)			0.46
No	47(394)	51 (148)	1.11	0.84 – 1.45	
Pain and function					
Pain interference with daily activities, past week (0=no interference, ref=0-3)[35]	39 (328)	32 (93)			0.13
4 – 5	22 (185)	28 (80)	1.58	1.11 – 2.24	
6 – 7	17 (145)	18 (52)	1.28	0.86 – 1.91	
8 – 10	21 (172)	22 (63)	1.35	0.93 – 1.98	
Pain interference with work, past week (0=no interference, ref=0-3)[35]	41 (341)	38 (109)			0.33
4 – 5	18 (151)	20 (59)	1.26	0.86 – 1.83	
6 – 7	18 (149)	15 (44)	0.92	0.62 – 1.38	
8 – 10	23 (189)	26 (76)	1.32	0.93 – 1.88	
Pain change since injury (ref=better)	74 (613)	75 (218)			0.60
Same	17 (139)	17 (49)	1.03	0.71 – 1.48	
Worse	9 (76)	7 (20)	0.77	0.46 – 1.31	
Clinical status					
Injury severity †† (ref=mild strain/sprain)[16]	57 (476)	60 (174)			0.73
Major strain/sprain with substantial immobility but no evidence of radiculopathy	20 (164)	20 (58)	0.99	0.70 – 1.40	
Evidence of radiculopathy or abnormalities	23 (188)	19 (56)	0.82	0.58 – 1.17	
Pain radiates below knee (ref=no)	75 (627)	77 (222)			0.74
Yes	25 (206)	23 (68)	0.95	0.69 – 1.30	
Work days missed because of back, previous year (ref=0)	68 (570)	64 (185)			0.14
1 – 10	22 (185)	24 (71)	1.22	0.88 – 1.69	
≥ 10	9 (71)	9 (27)	1.16	0.72 – 1.86	
Number other major medical problems (ref=0)	82 (687)	87 (251)			0.15
≥ 1	17 (145)	13 (39)	0.75	0.50 – 1.11	
Current health aside from injury (ref=excellent)	17 (143)	23 (68)			0.21
Very good	39 (325)	37 (106)	0.68	0.47 – 0.98	
Good	33 (275)	30 (87)	0.66	0.45 – 0.97	
Fair/poor	11 (89)	10 (28)	0.68	0.40 – 1.14	
General health, year prior to injury (ref=excellent)	20 (167)	27 (78)			0.16
Very good	40 (330)	36 (105)	0.67	0.47 – 0.95	
Good	31 (259)	30 (86)	0.70	0.48 – 1.01	
Fair/poor	9 (76)	7 (20)	0.61	0.34 – 1.07	
Health care					
Specialty, first provider seen for injury ◇ (ref=primary care)	38 (314)	38 (110)			0.92
Occupational medicine	5 (43)	6 (16)	1.01	0.54 – 1.88	

Domain and variables	Not re-injured N=833 % (n)	Re-injured N=290 % (n)	Odds ratio^	95% CI	P-value
Chiropractor	30 (251)	32 (92)	1.01	0.73 – 1.41	
Other	27 (225)	25 (72)	0.90	0.64 – 1.28	
Health care provider recommended exercise (ref=yes)	71 (593)	72 (208)			0.98
No	29 (238)	28 (82)	0.98	0.74 – 1.35	
Health care provider discussed ways to prevent further injury (ref=yes)	61 (509)	66 (191)			0.18
No	39 (322)	33 (97)	0.80	0.60 – 1.06	
Time from injury to first medical visit for injury ◇ (ref=0-6 days)	77 (644)	77 (224)			0.53
7 – 13 days	11 (90)	13 (38)	1.17	0.78 – 1.77	
≥ 14 days	9 (74)	8 (22)	0.83	0.50 – 1.37	
Health behavior					
Tobacco use (ref=no)	55 (462)	57 (164)			0.73
Yes (occasionally/frequently/daily)	44 (370)	43 (126)	0.95	0.73 – 1.25	
Alcohol Use Disorder Identification Test-Consumption (AUDIT-C)^^ (ref=negative) (AUDIT-C score of 0 – 3 for males, 0 – 2 for females)[25]	71 (591)	69 (200)			0.53
Positive (4 – 12 for males, 3 – 12 for females)	29 (242)	31 (90)	1.10	0.82 – 1.48	
Psychological					
Catastrophizing ## (ref=0-1)	34 (285)	35 (101)			0.16
Low (>1 – <2)	18 (150)	13 (39)	0.76	0.50 – 1.16	
Moderate (2 – <3)	29 (240)	29 (85)	1.03	0.74 – 1.45	
High (3 – 4)	19 (158)	22 (65)	1.30	0.89 – 1.90	
Recovery expectations[36] (0-10 scale, 10 = extremely certain will be working in 6 months, ref=10)	63 (528)	64 (185)			0.91
Low (0 – 6)	17 (143)	18 (52)	1.03	0.72 – 1.48	
High (7 – 9)	19 (162)	18 (53)	0.94	0.66 – 1.34	

Each baseline variable included in this table was associated (P < 0.10) in bivariate analyses with occupational back re-injury by one year of initial occupational back injury

Ref indicates reference group

^Odds ratios for all variables except age and gender were adjusted for age and gender

†By residential zipcode, using the Washington State guidelines classifications at http://www.doh.wa.gov/Data/Guidelines/RuralUrban

‡Derived from standard industrial codes (SIC)

¶Short-Form-36 version 2 (SF-36v2) Physical Function, Role Physical, and Mental Health scales; higher scores indicate better functioning[24]

††Rated by trained nurses based on medical records early in the claim

◇From workers' compensation database

^^The AUDIT-C score is a screening test for problematic alcohol usage[25]

##Mean of responses to three questions from the Pain Catastrophizing scale[22]

Biography

Dr. Keeney was a doctoral candidate in Health Services in the School of Public Health at the University of Washington when this research was conducted. He is now a Post-Doctoral Fellow in the Department of Orthopaedics at Dartmouth Medical School.

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Key Points

290 of 1,123 (25.8%) of Washington State workers who returned to work after a back injury resulting in work loss compensation reported an occupational back re-injury within 1 year.

Baseline predictors of occupational back re-injury that were significant in a multivariate model included male gender, jobs involving constant whole body vibration, previous worker's compensation claims of any type, previous similar back injury, possession of general health insurance, and fear-avoidance; obesity was protective against re-injury.

No variables in the pain and function domain were significant in the multivariate model. Other anticipated predictors, such as injury severity, offer of job accommodation, and overall health status, also were not significant in the multivariate model.

Table 1

Bivariate Associations (P ≤ 0.10) of Baseline Variables with Occupational Back Re-Injury by One Year after Initial Occupational Back Injury

Domain and variables	Not re-injured N=833 %(n)	Re-injured N=290 %(n)	Odds ratio^	95% CI	P-value
Sociodemographic					
Gender (ref=male)	64 (531)	74 (216)			< 0.01
Female	36 (302)	26 (74)	0.60	0.47 – 0.81	
Race/ethnicity (ref=White non-Hispanic)	72 (603)	74 (214)			0.04
Hispanic	15 (123)	10 (30)	0.64	0.41 – 0.99	
Other	13 (107)	16 (46)	1.26	0.86 – 1.86	
Employment-related					
Worker's description of job in following variables					
Heavy lifting (ref=not at all/rarely/occasionally)	51 (423)	41 (119)			0.02
Frequently	32 (264)	38 (111)	1.46	1.07 – 1.97	
Constantly	17 (145)	21 (60)	1.47	1.01 – 2.13	
Whole body vibration (ref=not at all/rarely)	71 (592)	62 (179)			0.01
Occasionally/frequently	21 (175)	23 (67)	1.08	0.77 – 1.54	
Constantly	8 (64)	15 (44)	1.94	1.25 – 3.00	
Physical demands (ref=sedentary/light)	23 (191)	17 (49)			0.02
Medium	34 (281)	31 (89)	1.20	0.81 – 1.79	
Heavy	22 (186)	26 (74)	1.45	0.95 – 2.22	
Very heavy	20 (168)	27 (78)	1.70	1.11 – 2.60	
Fast pace (ref=strongly disagree/disagree)	27 (229)	21 (61)			0.04
Agree	40 (336)	41 (120)	1.36	0.95 – 1.94	
Strongly agree	32 (265)	37 (108)	1.66	1.14 – 2.40	
Excessive amount of work (ref=strongly disagree/disagree)	49 (409)	41 (120)			0.01
Strongly agree/agree	50 (417)	58 (168)	1.45	1.10 – 1.92	
Pain and function					
Number pain sites (ref=0-2 sites)	53 (445)	45 (131)			0.01
3 – 4 sites	34 (287)	40 (115)	1.43	1.06 – 1.92	
5 – 8 sites	12 (101)	15 (44)	1.70	1.12 – 2.58	
Pain intensity, past week (0=no pain, ref=0-3)[35]	31 (257)	25 (72)			0.08
4 – 5	27 (228)	28 (81)	1.36	0.94 – 1.96	
6 – 7	24 (199)	28 (81)	1.59	1.10 – 2.32	
8 – 10	18 (149)	19 (56)	1.49	0.99 – 2.25	
Roland Morris Disability Questionnaire € (0=no disability) (ref=0-8)[19]	34 (287)	28 (81)			0.04
9 – 16	36 (301)	37 (108)	1.33	0.95 – 1.85	
17 – 24	29 (245)	35 (101)	1.55	1.10 – 2.20	

Domain and variables	Not re-injured N=833 %(n)	Re-injured N=290 %(n)	Odds ratio^	95% CI	P-value
SF-36 v2 Physical Function ¶ (ref=>50)[24]	29 (244)	22 (65)			0.03
41 – 50	20 (168)	22 (64)	1.43	0.96 – 2.14	
30 – 40	25 (206)	31 (90)	1.75	1.20 – 2.55	
<30	26 (215)	24 (71)	1.31	0.89 – 1.94	
SF-36 v2 Role Physical ¶ (ref=>50)[24]	27 (223)	21 (60)			0.10
41 – 50	20 (168)	19 (56)	1.29	0.85 – 1.97	
30 – 40	23 (192)	29 (83)	1.62	1.10 – 2.39	
<30	30 (250)	31 (91)	1.38	0.95 – 2.02	
Clinical status					
Previous similar back injury (ref=no)	57 (471)	42 (122)			< 0.01
Yes	43 (362)	58 (168)	1.73	1.31 – 2.29	
Previous injury (any type) with ≥ 1 month off work (ref=no)	78 (646)	69 (200)			0.01
Yes	22 (184)	31 (89)	1.51	1.11 – 2.06	
Number of self-reported worker's compensation claims before current injury (ref=0)	42 (349)	29 (83)			< 0.01
1	30 (253)	28 (82)	1.33	0.93 – 1.89	
2 – 3	13 (161)	25 (73)	1.77	1.21 – 2.58	
≥ 4	8 (64)	17 (50)	2.99	1.90 – 4.71	
Work days missed because of other health problems, previous year (ref=0)	40 (333)	37 (106)			0.05
1 – 10	50 (418)	58 (167)	1.34	1.01 – 1.79	
> 10	8 (66)	5 (14)	0.74	0.40 – 1.38	
Health care					
Health insurance (ref=yes)	72 (596)	81 (236)			< 0.01
No	28 (236)	19 (54)	0.59	0.42 – 0.82	
Health behavior					
Body Mass Index (BMI) (ref=<25)	28 (235)	30 (86)			0.03
25 – 29 (overweight)	37 (312)	44 (129)	1.01	0.73 – 1.41	
≥ 30 (obese)	34 (286)	26 (75)	0.67	0.47 – 0.96	
Psychological					
Blame for injury[36] (ref=work)	46 (380)	53 (155)			0.06
Self	23 (190)	19 (54)	0.67	0.47 – 0.95	
Someone/something else	15(124)	16 (45)	0.65	0.42 – 1.00	
Nothing/no one	14 (118)	11 (33)	0.90	0.61 – 1.34	
Work fear-avoidance (ref= <3, very low) ◇◇	24 (203)	11 (33)			< 0.01
Low-moderate (>3 – <5)	33(272)	38 (109)	2.49	1.62 – 3.84	
High (5 – 6)	43 (358)	51 (148)	2.63	1.73 – 4.00	
SF-36 v2 Mental Health ¶ (ref=>50)[24]	45 (371)	39 (114)			0.06
41 – 50	23 (194)	30 (87)	1.49	1.07 – 2.08	
≤ 40	32 (268)	31 (89)	1.11	0.80 – 1.54	

Missing, “don’t know,” and refusal responses for each variable were combined into one response for each variable (results not shown)

^Odds ratios for all variables except age and gender were adjusted for age and gender

€Roland-Morris Disability Questionnaire[19 – 21]

¶Short-Form-36 version 2 (SF-36v2) Physical Function, Role Physical, and Mental Health scales; higher scores indicate better functioning.[24]

◇◇Mean of responses to two questions from the Fear-Avoidance Beliefs Questionnaire work scale[23]

Table 2

Multivariate Model Predicting Occupational Back Re-Injury by One Year from Baseline Variables

Baseline Predictor	Bivariate Analyses		Multivariate Analysis		P-Value
	OR	95% CI	OR	95% CI	
Age, yr (ref = 35 – 44)					
≤ 24	0.53	0.29 – 0.95	0.67	0.35 – 1.28	0.23
25 – 34	1.13	0.79 – 1.62	1.35	0.90 – 2.01	0.14
45 – 54	1.05	0.74 – 1.49	1.12	0.76 – 1.66	0.57
≥ 55	0.85	0.52 – 1.38	1.01	0.59 – 1.74	0.97
Gender (ref = males)					
Females	0.60	0.47 – 0.81	0.68	0.47 – 0.99	0.04
Race/ethnicity (ref = white non-Hispanic)					
Hispanic	0.64	0.41 – 0.99	1.01	0.60 – 1.69	0.98
Other	1.26	0.86 – 1.86	1.38	0.91 – 2.11	0.13
Heavy lifting (ref = not at all/rarely/ occasional)					
Frequent	1.46	1.07 – 1.97	1.36	0.94 – 1.98	0.11
Constant	1.47	1.01 – 2.13	1.10	0.69 – 1.76	0.68
Whole body vibration (ref = not at all/rarely / occasional)					
Frequent	1.08	0.77 – 1.54	0.89	0.61 – 1.30	0.54
Constant	1.94	1.25 – 3.00	1.66	1.02 – 2.69	0.04
Physical demands of job (ref = sedentary/ light)					
Medium	1.20	0.81 – 1.79	0.94	0.60 – 1.48	0.79
Heavy	1.45	0.95 – 2.22	0.94	0.55 – 1.59	0.82
Very heavy	1.70	1.11 – 2.60	1.14	0.66 – 1.98	0.64
Fast pace (ref = strongly disagree / disagree)					
Agree	1.36	0.95 – 1.94	1.19	0.80 – 1.79	0.39
Strongly agree	1.66	1.14 – 2.40	1.17	0.73 – 1.83	0.49
Excessive Amount of Work (ref = strongly disagree/disagree)					
Strongly agree/agree	1.45	1.10 – 1.92	1.11	0.79 – 1.55	0.55
Number of Pain Sites (ref = 0 – 2)					
3 – 4 sites	1.43	1.06 – 1.92	1.17	0.82 – 1.66	0.39
5 – 8 sites	1.70	1.12 – 2.58	1.34	0.82 – 2.20	0.25
Pain intensity, past week (ref=0 – 3, 0 = no pain)					
4 – 5	1.36	0.94 – 1.96	1.00	0.65 – 1.55	1.00
6 – 7	1.59	1.10 – 2.32	1.30	0.81 – 2.09	0.28
8 – 10	1.49	0.99 – 2.25	1.21	0.71 – 2.06	0.49

Baseline Predictor	Bivariate Analyses		Multivariate Analysis		P-Value
	OR	95% CI	OR	95% CI	
Roland Morris Disability Questionnaire (ref = 0 – 8)					
9 – 16	1.33	0.95 – 1.85	0.95	0.58 – 1.56	0.85
17 – 24	1.55	1.10 – 2.20	1.36	0.72 – 2.57	0.34
SF-36 v2 Physical Function (ref=>50)					
41 – 50	1.43	0.96 – 2.14	1.08	0.66 – 1.78	0.76
30 – 40	1.75	1.20 – 2.55	1.16	0.65 – 2.06	0.61
< 30	1.31	0.89 – 1.94	0.79	0.40 – 1.53	0.48
SF-36 v2 Role Physical (ref=>50)					
41 – 50	1.29	0.85 – 1.97	1.10	0.65 – 1.85	0.73
30 – 40	1.62	1.10 – 2.39	1.16	0.63 – 2.12	0.63
< 30	1.38	0.95 – 2.02	0.87	0.45 – 1.69	0.68
Previous similar back injury (ref=no)					
Yes	1.73	1.31 – 2.29	1.47	1.06 – 2.02	0.02
Previous injury (any type) with ≥ 1 month off work (ref=no)					
Yes	1.51	1.11 – 2.06	1.14	0.80 – 1.64	0.46
Number of self-reported worker's compensation claims before this initial injury (ref = 0)					
1	1.33	0.93 – 1.89	1.02	0.69 – 1.52	0.92
2 – 3	1.77	1.21 – 2.58	1.32	0.85 – 2.06	0.22
> 3	2.99	1.90 – 4.71	2.29	1.34 – 3.92	< 0.01
Work days missed because of other problems, previous year (ref = 0)					
1 – 10	1.34	1.01 – 1.79	1.21	0.88 – 1.66	0.24
> 10	0.74	0.40 – 1.38	0.52	0.26 – 1.01	0.06
Health insurance (ref = yes)					
No	0.59	0.42 – 0.82	0.62	0.43 – 0.89	0.01
Body Mass Index (BMI) (ref = <25)					
25-29	1.01	0.73 – 1.41	0.93	0.65 – 1.33	0.70
≥ 30	0.67	0.47 – 0.96	0.59	0.40 – 0.88	0.01
Blame for injury (ref = work)					
Self	0.67	0.46 – 0.95	0.78	0.52 – 1.15	0.21
Someone / something else	0.90	0.61 – 1.34	0.93	0.61 – 1.42	0.75
No one / nothing	0.65	0.42 – 1.00	0.75	0.47 – 1.22	0.25
Fear-avoidance [ref = <3 (very low)]					
Low-moderate (>3 – <5)	2.49	1.62 – 3.84	2.03	1.27 – 3.23	< 0.01

Baseline Predictor	Bivariate Analyses		Multivariate Analysis		P-Value
	OR	95% CI	OR	95% CI	
High (5 – 6)	2.63	1.73 – 4.00	1.84	1.13 – 2.99	0.01
SF-36 v2 Mental Health (ref = >50)					
41 – 50	1.49	1.07 – 2.08	1.27	0.87 – 1.85	0.22
≤ 40	1.11	0.80 – 1.54	0.92	0.61 – 1.40	0.70

Missing, “don’t know,” and refusal responses for each variable were combined into one response for each variable (results not shown)

Each baseline variable included in this table was associated (P < 0.10) in bivariate analyses with occupational back re-injury by one year of initial occupational back injury

Ref indicates reference group

* Adjusted only for age and gender. The age and gender variables were unadjusted.

^ Adjusted for all other variables in the multivariate model